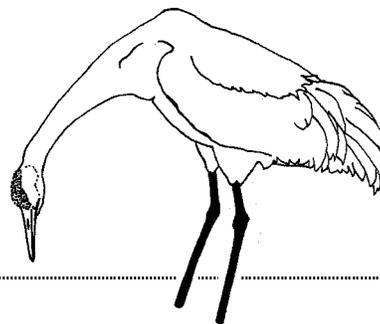


# General Husbandry

SCOTT R. SWENDEL AND JAMES W. CARPENTER



Captive cranes need a clean, safe, low stress environment to remain healthy and to breed. Because disturbances are stressful to cranes (Mirande et al. 1988 unpubl.), schedule and perform husbandry practices to minimize disturbance (see Chapter 6 for details). Frequent observation (Fig. 2.1) of confined cranes enables quick detection of changes in a bird's behavior (see Chapter 6). By understanding the behavior of cranes, managers can choose appropriate husbandry practices.

## Animal Welfare

Humane treatment of captive animals is an important part of the conservation ethic. The **Animal Welfare Act** (and USDA regulations 9 CFR Parts 1-3, as amended in Federal Register 1989) was enacted by the U.S. Congress to govern the use of animals in government-funded research projects. The USDA regulations currently exclude birds, but have been adapted for birds by some agencies. We recommend voluntary compliance with these guidelines.



FIG. 2.1. Early each day a caretaker, here Jane Nicolich, Patuxent's flock manager, walks through the colony to assess the health of each bird.

PHOTO DAVID H. ELLIS

An important requirement is that each institution create an **Animal Care and Use Committee (ACUC)**. Included are a veterinarian and a person who is not employed by the organization doing the research. The ACUC reviews proposed research projects and evaluates facilities. The January 1987 issue of **Laboratory Animal Science** is devoted to the effective use of an ACUC and provides more details on how these committees can operate. Other animal welfare guidelines are provided by the Canadian Council on Animal Care (1984) and the American Ornithologists' Union (1988).

## The Physical Environment

### Crane Pens

Crane pens should be large enough to prevent microorganisms and parasites from building up in the soil or in shelters. Normally, cranes are moved to a fallow pen each year (see below). Minimum pen sizes are presented in Chapter 12 and in Carpenter and Derrickson (1987).

The pen walls should be designed to minimize injuries. Use fencing that is smooth and lacks projections. Visual barriers serve the dual purpose of making the fence smoother and reducing stress on the cranes. Cranes are more likely to breed when they have visual barriers isolating them from their neighbors (see Chapter 6). Soft outdoor and indoor pen substrates help keep crane feet healthy. Grass, or other natural outdoor surfaces, and wood shavings inside shelters are good choices. Cranes that are locked indoors require light and ventilation.

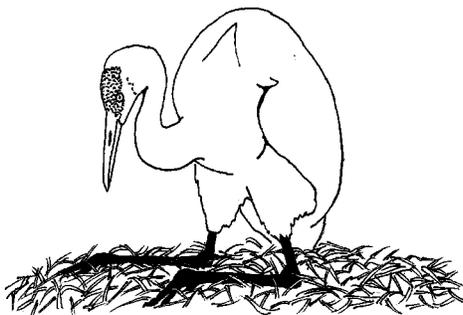
### Cleaning, Sanitation, and Pen Rotation

**OUTDOOR PENS.** Clean pens are important to the continued health of cranes. Pen rotation is one of the best ways to keep large outdoor pens clean. Rotation

allows many of the soil pathogens to die by removing the crane host that is a critical link in the life cycle of the pathogen. If cranes are rotated to alternate pens annually and the pen has 50 m<sup>2</sup> of space per crane, the outdoor pens do not normally need to be cleaned. If, however, the soil has a high pathogen load or is known to harbor one very dangerous pathogen, it is advisable to disinfect the outdoor pen before reintroducing cranes. This can be accomplished by tilling the topsoil and applying lime, formalin, or a commercial disinfectant that is effective against the disease agent(s) in question. Cranes are moved to the fallow pen in mid-summer, in fall, or just prior to the onset of egg laying (so the chicks have a clean pen). All pairs in a row or colony should be moved on the same day so all pairs are separated by an empty pen.

Cross contamination of pens can be minimized by using an antibiotic (antibacterial and antiviral) **footbath**. A footbath is a shallow pan at least 40 cm in diameter containing 6-10 cm of fluid and located at the doorway to each pen complex. Caretakers dip the soles of their shoes each time they enter and leave the pen complex. The bath is changed weekly, or more often if the bath is diluted by rain. The bath solution can contain any of several agents including Broad Spec, Environ, or Nolvasan.

**INDOOR PENS.** If the cranes have four-sided shelters with bedding, such as sand or wood shavings, clean the bedding at one or two day intervals. In pens with shavings on the floor, pick up the fecal material with a scoop or rubber glove. Sand floors can be cleaned by sifting the droppings through a 3-mm mesh screen. Sand, however, will occasionally get into chicks' eyes and cause conjunctivitis or other ocular lesions. Remove wet bedding during daily cleaning.



Wet bedding, especially wood shavings, promotes fungal and bacterial growth particularly during warm, wet weather. Chicks are more susceptible to *Aspergillus* and other pathogens than adult cranes. See Chapter 5 for details of cleaning chick pens.

At least annually, or more frequently depending on usage, indoor pens should be thoroughly cleaned. Remove the bedding and disinfect the floor and walls by spraying or wiping them with bleach or a commercial disinfectant diluted with water. Because disinfectants are potentially toxic to animals, they should be used judiciously; follow the directions on the label and never use a higher concentration than is recommended. Allow pens, especially the soil, to lie idle long enough for the chemical to be rendered harmless to the cranes (usually 1-2 days longer than the half life listed on the label). ICF has used Environ or Nolvasan mixed 1:250 with water and sprayed on soiled pen walls. These chemicals (see Appendix) were chosen because they have short half lives.

Change the bedding more often if the cranes are locked inside a shelter for extended periods. Put new bedding into the shelter after the building is thoroughly dry.

### Wading Pools

Shallow pools in which the cranes can wade and bathe can make the pen environment more natural and may promote breeding (see Chapter 3). Pools should either have a slow, continuous flow of water through them or be cleaned every 3-5 days (or more often if there is a chick in the pen). If the pool stagnates, deadly bacteria, such as *Clostridium botulinum*, may flourish. Other potential health hazards associated with wading pools are bacterial or parasitic infections through contamination by feces from the cranes, rodents, and wild birds. See Chapter 12 for details of pool construction and maintenance.

## Annual Cycle of Management Activities

Most activities related to crane management are seasonal in nature or should otherwise be done on a regular schedule planned to minimize disturbance. Figure 2.2 is an example of a schedule for such activities.

FIG. 2.2.

**Time line for maintenance activities.**

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC		
Minimize Disturbance	[Solid bar]													
Pen Rotation	[Solid bar]													
Communities	[Solid bar]													
Breeder	[Solid bar]													
Feed Breeder Ration	[Solid bar]													
Whooping Crane	[Solid bar]													
G. Sandhill Crane	[Solid bar]	[Solid bar]												
Provide Straw and Oystershell	[Solid bar]													
Whooping Crane	[Solid bar]	[Solid bar]												
G. Sandhill Crane	[Solid bar]		[Solid bar]											
Photoperiod Lights	[Solid bar]													
Whooping Crane	[Solid bar]	[Solid bar]												
G. Sandhill Crane	[Solid bar]	[Solid bar]												
Artificial Insemination	[Solid bar]													
Whooping Crane	[Solid bar]	[Solid bar]												
G. Sandhill Crane	[Solid bar]		[Solid bar]											
Operate incubators	[Solid bar]	[Solid bar]												
Egg Moves	[Solid bar]	[Solid bar]												
Snow Poles	[Solid bar]												[Solid bar]	
Chick Hand-rearing	[Solid bar]	[Solid bar]												
Chick Parent-rearing					[Solid bar]								[Solid bar]	
Mow Crane Areas					[Solid bar]								[Solid bar]	
Brail Chicks							[Solid bar]						[Solid bar]	
EEE Vaccination								[Solid bar]						
Sex Chicks									[Solid bar]				[Solid bar]	
Health Checks										[Solid bar]			[Solid bar]	

**Non-breeding Season**

Most activities that are not directly related to breeding are best conducted in the non-breeding season when cranes are less susceptible to disturbance. Further, the non-breeding season is usually less busy for caretakers. This is, in some ways, the best time to move cranes between pens because cranes are less aggressive during this period and the move will not disrupt reproduction. Fall moves allow cranes two or more months to adjust before the next breeding season. **Annual health checks** (or physical examinations) should also be conducted on the cranes in the fall, generally in conjunction with wing clipping.

**Winter**

Temperate and subarctic cranes can tolerate temperatures of  $-30^{\circ}\text{C}$  ( $-22^{\circ}\text{F}$ ) or colder as long as they have

shelter and food. All of these species require only a three-sided shelter (wind break). Subtropical cranes need supplemental heat or should be locked indoors when the temperature is below  $0^{\circ}\text{C}$  ( $32^{\circ}\text{F}$ ) (see Table 2.1). African Crowned Cranes should be kept inside during brief winter warm spells if the ground is still frozen. Other cranes may be allowed outside any time the temperature is higher than that listed in Table 2.1. On windy days these temperatures should be adjusted slightly upward to account for wind chill, but cranes usually seek shelter from the wind without assistance.

Unfortunately when cranes are locked inside, some may become stressed from the close contact with humans. All but the African Crowned Cranes may be let outside during brief cleaning periods unless they are overly stressed when herded into their house. Sliding doors that operate from outside the pen can make this operation easy, since most subtropical cranes will go back inside on their own within a few

**TABLE 2.1.**

**Ambient temperatures at which warm-climate cranes should be moved indoors and supplied with supplemental heat.**

SPECIES	LOCKED INSIDE	HEAT NEEDED
Black Crowned	0° C (32° F)	0° C (32° F)
Gray Crowned	0° C (32° F)	0° C (32° F)
Eastern Sarus	-5° C (23° F)	-15° C (5° F)
Brolga	-10° C (14° F)	-20° C (-4° F)
Indian Sarus	-20° C (-4° F)	-30° C (-22° F)
Blue	-20° C (-4° F)	-35° C (-31° F)
Wattled	-20° C (-4° F)	-40° C (-40° F)

minutes after their shelter is cleaned. If a crane attacks the keeper, either let the crane outside during pen servicing or wear protective gear when it is too cold to let the cranes out. Alternatively, one person can fend off the crane while another services the pen.

When wary cranes must be kept inside during pen servicing, stay low, approach indirectly, and avoid direct eye contact with the birds while inside the pen. It can help to provide a window in one side of the building to allow viewing of the crane without entering the pen. Additional translucent windows or skylights are useful for lighting the pens and providing solar heat during winter. Cranes stay healthier when their quarters are well-lit. See Chapter 12 for details of insulated buildings and heating systems.

### Egg Laying Season

One to two months before cranes are expected to lay eggs, change to Breeder Diet (Table 2.2) and supply crushed oyster shell (mixed with pelleted food or in a separate container) as a calcium supplement. Visual barriers must also be in place prior to the breeding season. Place nesting material in the pen before the cranes lay eggs to stimulate nest building. It is also important to condition the males to artificial insemination (AI) before the females are expected to lay eggs so the males will produce semen at the appropriate time to fertilize the eggs.

Initiate egg searches (see Chapter 4) when the cranes are expected to lay eggs. Do this in a way that balances the disturbance incurred by the searches with the importance of finding eggs immediately. Egg searches can generally be done from outside the pen.

Some cranes may not lay eggs if caretakers regularly enter their pens to search for eggs.

Cranes that breed at high latitudes often breed better when they experience artificially lengthened days (see Chapter 3 for details). Begin to extend the photoperiod a month or so before the intended start of egg laying to ensure maximum physiological response. This helps to stimulate an early breeding season prior to the onset of hot weather which causes most cranes to stop laying.

### Chick Rearing Season

Several activities are tied to the development of chicks. The chick-rearing house and its exercise pens should be repaired, cleaned, and disinfected before the expected hatch date of the first egg. Other major seasonal activities timed with chick development are sexing (Chapter 11C), flight restraint (Chapter 11E), and formation of release cohorts (Chapter 11D).

## Food and Drinking Water

### Crane Food

**DIETS.** Crane diets were adapted from poultry diets (Serafin 1982). Cranes consume about 4% of their body weight per day (Halibey 1979 unpubl.). Commercial diets have made it more convenient and less expensive to feed a controlled diet to cranes (see Appendix).

There are usually three types of formulated crane diets (Tables 2.2 and 2.3). Adult cranes receive Maintenance or Breeder Diets depending on the season. Chicks are provided a Starter Diet. Most formulated crane diets are composed largely of vegetable matter and less than 10% animal matter. The Patuxent diet is 15.0% protein (Maintenance Diet) or 22.0% protein (Breeder Diet). The ICF diet is 19.4% and 20.5% protein for Maintenance and Breeder Diets. Patuxent and ICF Breeder Diets also have a higher calcium level (2.45%) than the Maintenance Diets (1.0%). Starter Diets for chicks have increased protein, calcium, and vitamin B levels (Tables 2.2 and 2.3). Chicks also need a higher calcium/phosphorus ratio in their food than non-breeding adult cranes, because of mineral demands for bone and feather growth. Begin feeding Breeder Diet two months before the anticipated egg laying season (Russman and Putnam 1980).

TABLE 2.2.

## Feed formulas for chicks, non-breeding adults, and breeding adults.

	STARTER	MAINTENANCE	BREEDER
Ground yellow corn	24.4%	38.8%	41.2%
Soybean meal (44% protein)	—	13.1%	15.0%
Soybean meal (49% protein)	31.5%	—	—
Wheat middlings	12.0%	12.6%	10.0%
Fish meal (60% protein)	—	4.0%	5.0%
Ground oats	11.5%	15.7%	7.5%
Meat and bone meal	—	5.2%	4.0%
Alfalfa meal (17% protein)	5.0%	5.2%	5.0%
Corn distillers solubles	3.0%	—	1.5%
Brewers dried yeast	2.5%	—	2.0%
Corn oil	3.3%	—	—
Dried whey	1.2%	3.2%	3.5%
Limestone	1.5%	0.5%	3.5%
Dicalcium phosphate	3.0%	0.5%	1.0%
Iodized salt	0.25%	0.5%	0.5%
Vitamin/mineral premix	0.5%	0.5%	0.5%

## COMPOSITION OF FORMULATED DIETS

Percent protein	23.8%	19.4%	20.5%
Metabolizable energy, kcal/kg	2689	2530	2533
Percent calcium	1.4%	1.0%	2.45%
Percent phosphorus	0.90%	0.86%	0.89%
Percent methionine and cystine	0.7%	—	—
Percent Lysine	1.3%	—	—

The **type of protein** in a chick diet is very important. To minimize sulphur amino acids (cystine and methionine), Starter Diets (Table 2.2) should use **vegetable protein** only. Chicks that are provided Starter Diets containing high proportions of sulphur amino acids develop more leg and wing abnormalities than chicks that consume diets low in sulphur amino acids (Serafin 1982). Avoid feeding animal products, especially fish, on a daily basis because they contain more sulphur amino acids than most vegetable proteins.

**PELLET SIZE.** We recommend that crane feed, except for young chicks, should be pellets that are 5 mm in diameter and 6-15 mm long. Chicks less than 2-3 weeks old should be fed crumbles (2-5 mm diameter nuggets) and then gradually introduced to the larger pellets according to the schedule given in Chapter 5.

**FOOD STORAGE.** Feed should be stored at 1.7-4.4° C (35-40° F) with low humidity. It is very important that crane food be kept dry to eliminate mold and reduce bacterial growth. Storage areas should be clean and free of rodents and insects. Some ingredients in synthetic diets, especially vitamins, have a limited storage life (Carpenter 1979). If a refrigerator is not available, store no more than a one-month supply at ambient temperature; refrigerated food can be held up to three months. Feed can be frozen for up to one year, but it will lose some of its nutritional value, may become easier to pulverize, and may acquire odors or tastes that make it less palatable. Water condenses on feed bags removed from a freezer during warm, humid weather, so allow the bags to stand separately and dry.

TABLE 2.3.

**Vitamin/mineral premix for feed formulas<sup>1</sup>**

	STARTER	BREEDER AND MAINTENANCE
Choline chloride 60%	40%	40%
DL-Methionine	13%	13%
Vitamin E 227	7%	7%
Niacin 99.5%	7%	7%
Calcium pantothenate 160	1.1%	1.1%
Vitamin B12 300	0.5%	0.5%
Riboflavin 100	0.5%	0.5%
Vitamin A 650	0.25%	0.25%
Vitamin D3 400	0.1%	0.1%
Selenium 0.8%	27%	27%
Zinc oxide 72%	3.0%	3%
Manganese oxide 60	4.5%	4.5%
E.D.D.I. 79.5%	0.001%	0.001%
Biotin 1%	0.4%	0
Folic acid 10%	0.1%	0

<sup>1</sup> ICF custom premix. Commercial pre-mixes for turkeys or chickens are also used with manufacturer's inclusion rates followed.

### Crane Feeding

**Place the food** in a hopper feeder or an elevated bucket to reduce its accessibility to vermin and to facilitate removal of spilled food. Place the feeder in a shelter to shield it from rain, snow, and sunlight. To further limit water contact, keep the feeder at least 1 m from the water supply.

**FREQUENCY OF FEEDING.** In warm, humid climates, it is necessary to change the food daily. In temperate climates, check the food daily or at least three times a week, depending on the weather (more often when wet or snowy), and note the amount of feed consumed. Low use may indicate illness or a **taste aversion**. However, during warm winter days or the first days of spring, some cranes stop eating for a day or more and rely on stored fat. An easy test of food use is to  **mound the food into a cone** in the feeder and look for depressions in the cone that day or the next. Placing a favorite food, such as smelt or corn, on top of the food also confirms whether a crane is eating. Another method is to mark the food level and determine quantitatively how much the food

level is reduced. Be aware, however, of spillage and consumption by wild birds.

Discard wet or pulverized feed before it loses its nutritional value or becomes moldy. Completely change the feed monthly and disinfect the feeder or bucket if it becomes wet.

### Drinking Water

Cranes need fresh drinking water at all times. Constantly flowing, elevated, watering cups (Fig. 12.13) are preferred because they are the most sanitary watering system available and require a minimum of maintenance. Float-operated water troughs that automatically fill provide fresh water for extended periods and have also been used successfully. If cranes are housed in enclosures with fresh, running water, an artificial supply is not needed. Water should not flow from one crane pen to another. Clean the cups or automatic trough waterers at least once a week using a stiff brush. Check the water delivery system daily to make sure it is functioning properly. Nine-liter, heavy-duty, rubber buckets placed in a secure spot can be an alternate water source. However, these buckets require more effort to keep clean and they are a greater health hazard. If used, clean daily and disinfect once or twice each month. If an individual crane stands or defecates in its water container, elevate the container so the crane can no longer do so. Buckets should always be kept on hand for use when the automatic waterers fail or freeze.

In cold climates, drinking water may require heating to prevent freezing. Some automatic watering systems have built-in heaters. Flowing water may not require heating, but for buckets, a pole-type water heater (see Appendix) works well.

## Handling and Transporting Cranes

### Handling and Physical Restraint of Cranes

**SAFETY PRECAUTIONS.** The capturing and restraining of cranes sometimes causes injuries to long legs, necks, and wings. Fledged colts seem particularly vulnerable to wing injuries. Fleeing cranes also hurt themselves by crashing into fences or flight netting. To minimize injury, we recommend slowly herding cranes into **capture corners** (padded corners lined

with tennis netting or another soft material). Once the cranes are cornered, the caretakers rush in the last few meters to grab the birds.

Capturing and restraining cranes can also be risky to handlers because of potential injury from the bill or feet. When in full attack, a crane stabs with the bill, rakes with the talons, and strikes with the wings. A single stab can blind a person. Anecdotes are available of one human mortality and other near death injuries from crane bills (e.g., Bent 1926:227). Most experienced handlers have many minor scars. Some caretakers have sustained blows to their protective goggles. Always wear **eye protection** when capturing large cranes or dangerous individuals, and when performing AI, use leather leg coverings (chaps) to protect legs against claw and bill injuries. Aggressive cranes can be fended off by one person holding a **broom** (Fig. 2.3) or **T-stick** (a lightweight, 1-m long handle with a sturdy wooden crossbar at one end) against the crane's chest to keep it at bay.

Cranes that thrash around or peck at the handler while being restrained can usually be calmed down by covering the crane's head and eyes with a **hood**. A hood is a tube-shaped piece of fabric that can slip over the head, bill first, and then be fastened around the back of the head to keep it in place. At Patuxent, hoods are seldom used except with chicks during veterinarian exams. When using a hood, keep the nares uncovered. It is advisable to place a rigid paper or plastic disk over the crown to lift the fabric away from the eyes and thereby eliminate corneal abrasion.

**CAPTURING ADULT CRANES.** Two to four people should herd the crane into a capture corner. Approach the crane slowly with arms outstretched to herd the crane into the desired location. When the crane is about to escape past the caretakers, rush in and grab the bustle (the rearward, protruding, elongate tertiaries), both wings, or one wing (humerus) and the neck. If the crane goes into a shelter, catch it as quickly as possible so that it does not jump into a wall and injure itself. For cranes that tend to jump, angle your arms upward as well as outward when cornering the crane, and be prepared to grab a wing as the crane tries to jump over or past you.

Parent-reared and wild-caught cranes are usually more difficult to capture. For such birds, a special capture corner is important and more people may be required. The wildest cranes may require a temporary capture lane constructed of wire panels (Fig. 2.4).

Hand-raised cranes are usually easier to capture. Often a single person can approach close enough for

the capture, although some hand-reared cranes are aggressive and dangerous enough that two people are required; one diverts the crane while the other quickly grabs the crane by the wing and the base of the neck. Most cranes that are captured regularly (as for AI) can be trained to go to the same part of the pen each time the AI crew herds them in a certain manner.

**RESTRAINING ADULT CRANES.** Restrain wings and legs as soon as possible after catching the crane (Fig. 2.5). The handler immediately pulls the crane's body against his/her own and turns away from the bird's



FIG. 2.3. Brooms are used to defend against aggressive cranes; Linda Miller retrieves the chick while Jane Nicolich defends and Scott Hereford exchanges the chick's food and water.

PHOTO DAVID H. ELLIS



FIG. 2.4. A portable capture lane is constructed of rigid, self-standing panels; Carlyn Williamson (left) and Jane Nicolich herd cranes. Also note tennis netting, capture corner.

PHOTO DAVID H. ELLIS



FIG. 2.5. Restrain wings and legs after capturing an adult crane. For very dangerous birds, the head can be restrained by a second person. Scott Hereford (left) and Thom Lewis with a Whooping Crane.

PHOTO DAVID H. ELLIS



FIG. 2.6. Hold the adult crane's wings and body with one arm and its legs with the other; Sandy L. Meyerhoff.

PHOTO GLENN H. OLSEN

bill to avoid facial injury. A second person should hold the head of cranes that peck people. Restrain the head by encircling the bird's upper neck with one hand without restricting the airway; do not cover the nares. Hood if necessary. Another method is to hold the wings and body of the crane with one arm and the legs with the other (Fig. 2.6). Allow the lower legs to flail if they do not need to be folded for the procedure. Grasp the legs just above the hocks, but always place one finger between the hocks (Fig. 2.11) to prevent the legs from abrading one another. Make sure the tarsi cannot contact the crane's neck or the person holding the crane.

If the crane's legs must be folded, gently force the tarsi around, but if the crane locks its hocks rigidly, **do not force the legs to fold**. Instead, maintain steady pressure on the tarsi until the crane allows you to fold the legs. When holding a crane with folded legs, support the crane's weight with the arm holding its body. **Do not support the crane's weight on its folded legs**. Do not keep a crane's legs folded for more than 30 minutes. These precautions will help prevent slipped tendons, capture myopathy (Carpenter et al. 1993), and in some cases (usually in chicks), leg fractures. The leg-folded carry is the primary method used at ICF for all but Whooping Cranes and individuals with a history of leg problems. It is the most convenient carry and helps avoid injury to cranes and humans caused by flailing legs, but has been implicated in some crane injuries.

At ICF, cranes whose legs are folded are sometimes placed in a sitting position on the ground for examinations or treatments (Fig. 2.7). Kneel with your legs surrounding the crane's wings but without placing weight on the crane. Use your hands to hold the crane down if it struggles to rise. This position is useful for examining the head and dorsum or force feeding.

For brief periods of restraint, it is often helpful to hold and stroke the crane as for AI while a second person quickly examines the crane or administers medical treatments. AI stroking is also effective in neutralizing an aggressive crane.

**RELEASING CRANES AFTER RESTRAINT.** When releasing a crane, allow its legs to touch the ground before letting go of the body or wings. We hold the bustle or one wing briefly while releasing the legs to insure that the crane is stable on its feet. As the crane gains stability, move forward a step or two with the bird. These precautions help prevent leg injuries to cranes that are unable to stand on their own without a few seconds of support. This practice is not advisable



FIG. 2.7. Scott R. Swengel restrains a Brolga by sitting across it. Only the hands actually press down on the bird.

PHOTO DAVID H. THOMPSON



FIG. 2.8. Yuri Markin weighing a Siberian Crane chick in cloth sack; Mini Nagendran looks on. Northwest Siberia.

PHOTO DAVID H. ELLIS

for cranes that thrash violently on release because they are more likely to become injured by thrashing about than from release while temporarily unstable.

**HANDLING CHICKS.** Chicks are more fragile than adult cranes. Growing legs, wings, and flight feathers are especially vulnerable to injuries. Use less force when capturing and restraining chicks. It is also important to minimize the length of time that chicks are restrained because chicks seem to become severely stressed after only a few minutes of handling. Chapter 5 describes the proper methods of handling young crane chicks. Chicks that are close to adult size should be captured and held like adults except with extra caution.

### Weighing Cranes

Young chicks can be placed in a cardboard box that is then placed on a scale (see Chapter 5). The box should be tall enough to prevent the chick from climbing out, and a carpet or mat should be placed in the box for good footing. The caretaker should keep one hand close to the top of the box to make sure the chick does not climb out or tip the box.

Larger cranes (>2 kg) can be weighed on a platform scale. Some cranes are calm enough to stand on the scale on their own. ICF currently weighs cranes while being held by a person standing on a scale.

A 10-15 kg capacity suspension spring scale with 0.1 kg accuracy can be used to more accurately weigh cranes in their pens or in the field. The method used for many years with minimal injury is to place the

crane in a cloth sack tail first, with the neck and head projecting from the bag (Fig. 2.8). Gather the slack material into a roll over the crane's back, and pierce the hook of the spring scale through the bag just under the roll. Suspend the crane and bag from the scale, while holding one hand just under the bag to control the crane's movements while in the bag. Weighing cranes in this way requires that the crane's legs be folded. Occasional injuries have resulted from this method. An alternative method employs a weighing sling (that allows for the legs to be left unfolded). Perhaps the simplest sling is a meter square net that is wrapped around the crane's body, then hooked in four or more places onto the scale. Patuxent has developed an innovative cloth sling with Velcro straps in the front and rear to restrain the bird's wings (Fig. 2.9).

### Transporting Cranes

To minimize stress, move birds as little as possible (Mirande et al. 1988 unpubl.). In some facilities, pen rotation can be accomplished by merely herding the bird into the adjacent pen. For moves of less than 200 m, carry the crane while walking to the new location. For longer moves, hand carry the crane into a vehicle and hold it during transport. Use a hood for nervous or aggressive birds. For long-distance moves, crate the crane. If the crate is transported in an open truck moving at highway speeds, tie the crate down, otherwise wind drag may blow it over or even out of the truck. When driving, avoid abrupt turns, sudden changes in speed, and bumps.



FIG. 2.9. Dan Sprague weighs a Sandhill Crane using a sling with Velcro fasteners.

PHOTO DAVID H. ELLIS

If the crane must wait for more than a few minutes after capture, place it in a crate (Fig. 2.10) until it will be examined. Never leave a crane crated for more than 10 minutes when the temperature is above 30° C (86° F) to avoid heat stress. When shipping cranes by air, crate design and shipping arrangements should comply with International Animal Transfer Association (IATA) guidelines available from the airlines or ICF.

**CRATES.** Crates for adult cranes should be large enough for the crane to stand comfortably with its neck recurved, but small enough to prevent the crane from opening its wings or jumping enough to hurt itself. A good generalized crane crate has **inside dimensions** of 95 cm high × 40 cm wide × 90 cm long. We sometimes use double crates with a solid divider for carrying two cranes. The tallest cranes, Wattled and Sarus, need only a 100 cm tall crate, and shorter cranes, Demoiselle, Hooded, and African Crowned Cranes, should have crates proportionally smaller. For Demoiselle Cranes, crates should be 75 cm high × 30 cm wide × 65 cm long.

Most airlines will not accept crates taller than 105 cm. Construct crates to minimize the outside dimensions while maintaining adequate inside size and overall strength. If crates are taller than 80 cm, check with airlines before booking a shipment to make sure the oxygenated cargo hold of the plane has a large enough door. Label the crate with appropriate instructions, and instruct the airline personnel to keep the crate upright while moving it into the cargo hold.

To prevent feather injuries when transporting a chick, adjust the crate size to prevent the chick from turning around. For example, most adult Florida Sandhill Cranes can only with difficulty turn around in a 40 cm wide crate. For a 3-month-old Florida Sandhill chick, 35 cm would be a better width. In general, the crate should be 12.5 cm wider than the bird with folded wings. Length and height should be proportionately adjusted.

**TEMPERATURE.** Different species of cranes tolerate heat and cold differently. Subtropical cranes can withstand heat better than temperate ones. Red-crowned and Siberian Cranes are the least heat tolerant and the most cold tolerant of all cranes. Use the conditions in the natural environment of the species to judge its likely tolerance to heat and cold. During a long road trip in hot weather, check on the crane hourly or more often if stress is likely. At some of these checks, place a 6-cm deep water dish just inside the door of the crate for a few minutes. Avoid airline shipments when the temperature is above 21° C (70° F) and below -1° C (30° F). The airlines themselves may also have restrictions. Normally these rules allow shipment only



FIG. 2.10. Cranes are routinely transported in special crates. Bryant Tarr and Julie Langenberg pose next to a double crate and a juvenile Siberian Crane on its way to India, January 1994.

PHOTO DAVID H. THOMPSON

between 7° C (45° F) and 27° C (80° F), but a veterinarian's letter of recommendation can sometimes persuade the airline staff to waive the rule. If the flight is nonstop and the crate will not sit outside before or after transport, it may still be possible to transport birds outside this temperature range. Allow for unforeseen events that may change the flight schedule and jeopardize the bird.

**FOOD AND WATER.** Adult cranes do not need food during trips of less than two days. The higher the temperature, the more often cranes need to drink during transport. At cold to moderate temperatures, cranes need to drink after one day of travel. Placing a familiar water dish just inside the door for 1/2 hour will give the crane adequate time to drink. Never install a dish as a permanent part of the crate, because birds can injure their feet or legs, break blood feathers, or hurt their heads and necks on such structures.

**SPECIAL NEEDS OF CHICKS.** Young cranes, especially those less than 4 months old, require special care. Because they are less tolerant of environmental extremes than adults, young cranes should not be transported except for special purposes, and even then they should be accompanied by a caretaker. Young cranes need water every few hours instead of once a day, and at least one good feeding per day. In addition, young cranes are prone to leg and wing injuries during transport; provide extra floor padding in the crate.

**MATERIALS AND CONSTRUCTION OF CRATES.** The sides of the crate, including the door, can be made with 0.25-in (0.6-cm) plywood and reinforced along all edges with 2 × 4 cm strips of wood. The floor should be 0.5- to 0.75-in (1.3- to 2-cm) plywood. The top can be of plywood or some other strong material. Mesh hardware cloth (1 cm) sandwiched between two layers of tennis wind-netting will serve to protect the crane's head and allow ventilation while restricting view and thereby reducing disturbance. For greater ventilation during warm weather shipments, provide a similarly constructed window over one-third to one-half of the back of the crate. It is also advisable to provide rows of 2-3 cm diameter ventilation holes near the top of the crate. However, unless the holes are covered with mesh, they increase the chance of injury if the crane protrudes its bill through a hole.

Place a 5 cm layer of wood shavings on the carpet to absorb the crane's feces. The door of the crate should be along the shortest side and slide up and down in a narrow track. The top of the door should

have a fastening system that permits the door to be locked. Attach handles made of 2 × 2 cm strips of wood running the length of the sides near the top.

**PREVENTING INJURIES.** Toenail and wing trauma are the most common injuries observed when transporting cranes. Minimize these injuries by brailing the wings (see Chapter 11E), taping pads on the carpus of pinioned wings, eliminating rough edges inside the compartment, fastening grippable floor material very securely along its perimeter, and choosing an appropriate crate size. The groove for the sliding door should be as narrow as possible so that cranes cannot get their toenails hooked in the groove during transport.

**LABELING.** Label the crate "LIVE BIRD" on at least two sides and "THIS SIDE UP" on all four sides. "DO NOT TIP" and "DO NOT FEED OR WATER THIS BIRD" are also useful labels. Write the names, addresses, and phone numbers of the sending and receiving parties on the crate so that the airline may contact the parties if there are any difficulties during the shipment. IATA requires that feeding and watering instructions be attached to the crate.

**CARE OF RECENT ARRIVALS.** Before a crane is shipped to you, learn about the crane's behavior, food requirements, and habits to provide better care when it arrives. Try to use feeders and waterers similar to the ones to which the crane was accustomed, then change over gradually to your system. If the crane does not eat immediately, sprinkle its previous foods on top of the new diet to encourage use of the new food.

## Marking Cranes

### Bands

**Metal bands** engraved with an identification (ID) number and placed above one hock make good permanent ID markers (see Appendix). If the sex of the crane is known before permanent banding of the bird, males can be banded on one leg and females on the other. This makes paired cranes individually recognizable at a distance.

**Colored leg bands** allow more recognizable marking combinations than aluminum bands and are especially useful in making behavioral observations of cranes in groups. Different colors and positions of one to three leg bands allow for thousands of combinations.



FIG. 2.II. Crane band showing coded information for captive cranes: color (taxon), 84 (hatch year), 032 (specimen number), and incised white ring (sex). Numbers on bands for release birds should be taller (at least 2 cm) and fewer to allow reading at 300 m with a telescope. (Note fingers between crane's legs preventing abrasion.)

PHOTO DAVID H. ELLIS

Color bands and aluminum bands can be combined to generate additional marking combinations. Bands made of laminated plastic (e.g., Gravoply, see Appendix) with two layers of contrasting colors can be engraved with unique combinations of letters and numbers. At Patuxent, we engrave a narrow ring high on the band for males (Fig. 2.II) and low for females.

To make color bands, cut strips of plastic of the appropriate size from a sheet of 3-mm thick plastic. Next, engrave the alpha-numeric code on the plastic. Heat the plastic strips in a teflon-coated and lubricated (use non-stick cooking spray or mold release) electric frying pan set at 130° C (266° F). Using a higher temperature will distort characters that are engraved in the plastic. Some plastics become pliable enough to form into bands after submersion in boiling water. When the strips become pliable, quickly form them into the right shape around the proper size dowels (wear gloves during this step of the procedure). The bands will cool and become rigid in a few seconds, so roll them quickly.

Wrap the plastic 1.25-1.75 times around the dowel, depending on the height of the band. Tall bands require less overlap than short bands. The more a band overlaps, the more difficult it is to attach and remove. When making plastic bands that wrap around 1.25 times, choose plastic strips

that are 4-4.5 times as long as the band's inside diameter. For bands that will be wrapped around 1.75 times, cut strips that are 6-6.5 times the length of the band's inside diameter. The width of the plastic strip is usually 25-80 mm.

**ATTACHING COLOR BANDS.** Color bands require softening in 50° C (122° F) water to make them pliable enough to put on. The band will harden back to its old shape very quickly as it cools. If the band is wrapped around 1.25 and 1.75 times for 80 and 25 mm tall bands, respectively, the crane will be unable to remove the band with its bill. If you wish to glue (or weld) the band closed, place a few drops of acetone between the overlapping ends and hold the band closed for 10-15 seconds.

**BAND SIZE.** The best band diameter is 14 mm inside diameter for small cranes (Black Crowned, Gray Crowned, Demoiselle, and Hooded), 18-21 mm inside diameter for large cranes (Sarus and Red-crowned), and 16-18 mm inside diameter for the remaining cranes. Aluminum bands are usually 12-16 mm high, while color bands are taller (25-80 mm) to make them easy to see. Large (>40 mm high) color bands allow more room to engrave numbers and letters. Small (25-40 mm tall) color bands are preferable if cranes will have two or more color bands.

Bands that are stacked one on top of the other should be the same diameter and have plenty of overlap to prevent the upper band from sliding over or under the lower. An interlocking aluminum band placed between two color bands also prevents one color band from slipping down over the other (S. A. Nesbitt, Florida Game and Fish, Gainesville, Florida, personal communication).

### Other Marking Methods

**Tattoos** on the underside of the patagium are useful for permanent marking of birds but, like aluminum bands, are not good for long-range identification. **Wing tags** are poor markers because cranes often destroy them after a few months or years.

**Neck collars** can be dangerous to cranes. The birds can get the tips of their long bills caught in the upper end of the collar and die from starvation or neck injuries. Unless further experimentation reveals that some collars are safe, we recommend against using them.

**Transponders** (coded electronic microchip implants) are the newest identification method to be used for cranes. The small (2 × 11 mm), sterile,

uniquely coded microchips are injected by syringe under the skin, where they can be detected and the code number read by a hand-held electronic scanner up to 0.5 m. Transponders are becoming the standard method for permanent identification of zoo animals. However, they are not useful for long-range identification, and the systems are expensive (ca US\$4-10/microchip and US\$250-1000 for the reader). The World Conservation Union (IUCN) has recommended the Trovan/A.E.G. system (see Appendix) as the global standard, and the dorsal base of the neck as the preferred implantation site for cranes. Zoos routinely using transponders in cranes have reported no health problems associated with the microchips. Transponders may also be useful for released cranes, where long-term permanent identification of even a partially consumed carcass is important.



## Literature Cited

- American Ornithologists' Union. 1988. Report of committee on use of wild birds in research. *Auk* 105 (1, Supplement):1A-41A.
- Bent, A. C. 1926. Life histories of North American marsh birds. Smithsonian Institution, U.S. National Museum Bulletin 135.
- Canadian Council on Animal Care. 1984. Guide to the care and use of experimental animals, Vol. 1. Public Health Service, Canadian Council on Animal Care, Ottawa.
- Carpenter, J. W. 1979. An outline of the treatment and control of crane parasites. Pages 101-108 in J. C. Lewis, editor. Proceedings 1978 Crane Workshop. Colorado State University Printing, Fort Collins.
- Carpenter, J. W., and S. R. Derrickson. 1987. Infectious and parasitic diseases of cranes: principles of treatment and prevention. Pages 539-553 in G. W. Archibald and R. F. Pasquier, editors. Proceedings of the 1987 International Crane Workshop. International Crane Foundation, Baraboo, Wis.
- Carpenter, J. W., N. Thomas, and S. Reeves. 1993. Capture myopathy in an endangered Sandhill Crane. Pages 111-112 in J. H. Olsen and M. Eisenacher, editors. Proceedings 1989 Annual Meeting American Association of Zoo Veterinarians.
- Halibey, T. 1979 unpubl. Food and feeding habits of captive cranes. International Crane Foundation report.
- Mirande, C. M., J. W. Carpenter, and A. Burke. 1988 unpubl. The effect of disturbance on the reproduction and management of captive cranes. Paper presented at 1988 North American Crane Workshop. 18 pp.
- Russman, S. E., and M. S. Putnam. 1980. Nutrition and successful propagation of cranes. Pages 261-282 in E. R. Maschgan, M. E. Allen, and L. E. Fisher, editors. Proceedings of the First Annual Dr. Scholl Nutrition Conference.
- Serafin, J. A. 1982. The influence of diet composition upon growth and development of Sandhill Cranes. *Condor* 84:427-434.
- United States Department of Agriculture. 1989. Part IV, Department of Agriculture Animal and Plant Health Inspection Service: 9 CFR Parts 1,2, and 3, Animal Welfare; final rules. *Federal Register* 54(168):36112-36163.

